PATENT
Attorney Docket No. 0329-0009.01

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:
Ulrich Müller, et al.

Serial No.: 10/677,880

Filed: October 2, 2003

Examiner: Vikkram Bali

Art Unit: 2623

For: FLATNESS MEASUREMENT SYSTEM FOR METAL STRIP

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DECLARATION OF DR. ULRICH MUELLER

I, Dr. Ulrich Mueller, hereby declare as follows:

1) I am named co-inventor of the invention described and claimed in the above-identified patent application, U.S. Patent Application Serial No. 10/677,880.

2) I am presently employed by Betriebsforschungsinstitut (BFI) VDEh-Institut für angewandte Forschung GmbH as a deputy department manager. I have worked at BFI for 26years, and have over 20years experience in the field of rolling mill control systems.

3) In 1973, I received my Diploma from the Technical University of Clausthal. I also received a doctorate from the Technical University of Clausthal.

4) It is my understanding that the United States Patent and Trademark Office has rejected the claims of the above-identified patent application based on the combination of U.S. Patent No. 5,367,378 to Harding et al. and the paper written by R. Pirlet entitled "A Non-Contact System for Measuring Hot Strip Flatness." It is also my understanding that the Examiner's position is that it would have been obvious to a person of ordinary skill in the art, at the time the invention was made, "to modify the inspection method to use for the measurement of panels, as described in Harding et al., by introducing the method of measuring the shape of the moving hot metal strip, as taught by Pirlet in a non-contact system for measuring the hot strip flatness (Office Action of October 20, 2004, page 3). It appears to be the Examiner's position that both of the cited references are directed to solving the same problem of measuring the metal strip.

5) As one of skill in the art, it is my opinion that, for the reasons discussed below, the two references are not directed to solving the same problem. Thus, I do not believe that it would have been obvious to combine the two cited references or that one of ordinary skill in the art would have been motivated

to do so. In fact, for the reason discussed below, one of ordinary skill would have considered the system in Harding et al. not applicable to the problem presented and solved by the present invention.

6) First, the teaching of Harding et al. is not relevant to our problem of having to measure the flatness of a moving, extremely hot metal strip. That is because unlike the reflective surface in Harding et al., we were faced with a surface which is typically not reflective but, in fact, is hot red/orange in its appearance, as shown in the attached photograph of our system. Because of the intense, non-reflective color of the moving hot metal strip, I believe that one of ordinary skill would not have considered it possible to effectively project line patterns onto the strip and measure the line patterns. Line patterns are based on the idea of projecting an original picture (a grid as in Harding et al. or through a slide as claimed in current claim 14) onto a surface by shining light through the original and thereby creating illuminated areas and non-illuminated areas on the surface (i.e., the line pattern). The shape of the thus created lines is used to analyze the condition of the surface. For this analysis, it is, however, crucial that the line-borders are clearly detectable by the camera and that any distortion to the line-border only stems from surface-deficiencies. Distortions

to the line borders that stem from other causes would make the system unusable.

7. A person of ordinary skill would, to my understanding, not have believed that such a projection of a line pattern onto a hot metal strip would work, as the red-glowing metal strip itself emits light. This leads to the situation where the areas non-illuminated by the light coming from the grid (that is the area that is supposed to be dark in order to create the necessary line border) are not dark but glowing bright red. I believe, that the one of ordinary skill would not have thought the light-gradient between the illuminated and non-illuminated areas to be strong enough to make out a clear line-border and would thus not have considered that such a system could work reliably with red-glowing hot metal strip. It would have been his belief, that the crucial light-gradient would only be made possible by high powered lasers, like the ones already discussed with regard to U.S. Patent No. 5,488,478 to Bullock et al. or in the Pirlet article.

8. Second, hot metal strips of the type that we deal with often contain many irregularities which appear as random darkened areas on the surface of the strip. I believe that this, too, would have had the person of skill in the art consider it difficult to effectively project and measure line patterns onto the hot metal strip. These darker areas are due

to the difference in temperatures that the areas of the metal strip might have, as it leaves the finishing-stand.

9. Thirdly, and perhaps most importantly, the problem with systems that work on reflective surfaces, as described in Harding et al. is that they have to rely on the fact that the panel itself is always in one definite position relative to the grid and the camera with reflective surfaces. The image of the projected grid can only be seen, if the camera is situated in a very specific position, as shown in scenario A of the attached handdrawn sketches. This is due to the fact that with reflective surfaces, the incident angle of light is the same as the angle of reflection. If the complete panel to be analyzed is not in the position assumed, the camera will analyze a reflection that greatly differs from the reflection that comes from a panel in the assumed position. This difference in picture does not, however, stem from surface defects but simply from a shifted panel. Thus, even with panels without surface defects, the system would consider the perfect panel to be faulty, because it is seeing an unexpected picture, as depicted in the scenarios B and C in the attached sketch.

Looking at the scenarios of A1 and B2 of the further attached handdrawn sketches, it also shows, that slight tilts of the panel also lead to scenarios where the system does not work. Taking into account that the strip can be vibrating as it leaves

the finishing-stand, clearly one would not consider a system that only works with an absolutely stationary reflective surface to work with moving hot metal strip.

10. Finally, the fact that the strip is moving presents additional challenges in measuring its flatness that are simply not present in the measurement of a stationary metal panel, as described in Harding et al. Hot metal strips leaving the finishing-stand are frequently subject to the phenomenon so called "fluttering." Here the strip is oscillating up and down in the perpendicular direction to the transport direction up to 0.5 m. Clearly, no sensible measurement would be possible in this situation, if the strip was reflective. Thus, there are multiple reasons, why the one of ordinary skill in the art would not have considered Harding et al. at all relevant for the problem at hand.

11) Harding et al. describes the need to take several pictures from different points in order to measure the flatness of the reflective metal surface (column 4, lines 45-46). This, in fact, is required when one is dealing with reflective surfaces of the type described in Harding et al. This is necessary, in order to establish whether the distorted picture that the camera sees is due to the disposition of the panel itself or actually due to a surface defect which one tries to analyze. We, on the other hand, take a single picture of our

hot metal strip. For this additional reason, I believe that one of ordinary skill would not have considered the system described in Harding et al. as being adaptable to our system, especially if one takes into account that strips of the kind to be analyzed in our system are moving with speeds of 15 to 20 m/sec which means that the second camera shot - as necessary for the method according to Harding et al. - would see a completely different picture than the first shot. Stated more simply, the system according to Harding et al. is only operational with stationary objects.

12) The systems described in Harding et al., and that described in our own application, are not easily interchangeable, and one cannot assume that what works in one system will work in a different system. For example, in our work, we have recently been asked to investigate whether the system described in the above-identified patent application can be used to measure a cold moving strip with a reflective surface, (which in itself shows that the industry with knowledge of Harding et al. recognizes Harding's limited applicability to stationary objects and has not found means to analyze moving reflective surfaces). We have attempted to employ the system described in our application for such measurements but, to date, have been unable to provide an accurate measurement using our system. This is, in part, a result of the different nature of

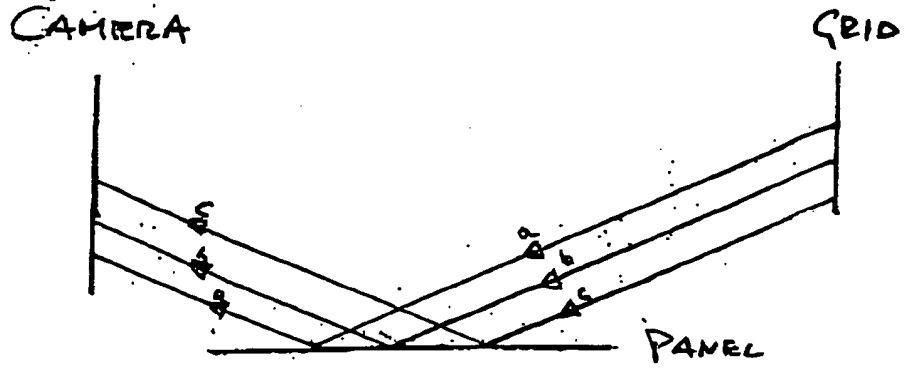
measuring a reflective surface and measuring a flat, hot metal strip, as described in this application. It is for this additional reason that, as one of ordinary skill in the art, I do not believe that the teaching in Harding et al. would have led others of ordinary skill to look to the Harding et al. teaching for the purpose of measuring the flatness of a hot metal strip.

-13) I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that the statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 USC 1001 and that such willful false statements may jeopardize the validity of the application or any patents issued thereon.

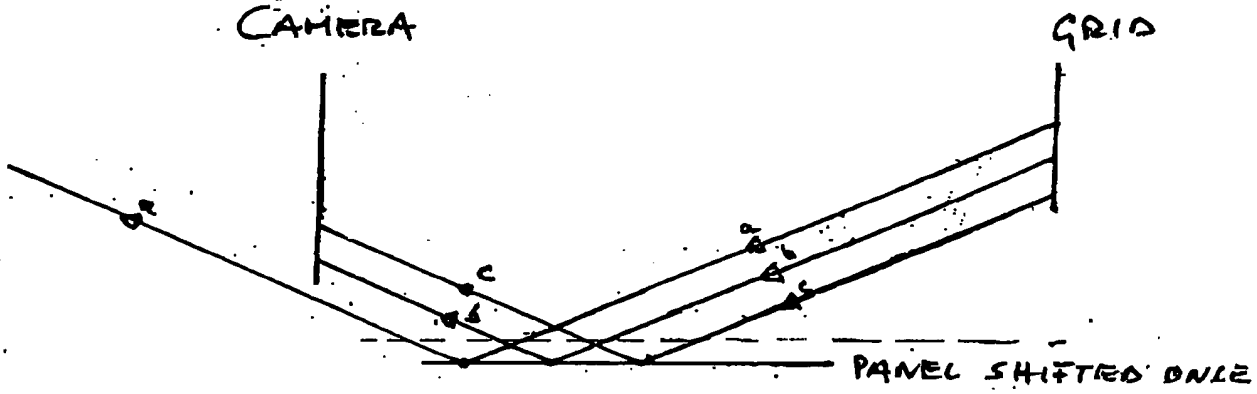
Ulrich Stille 19 April 2005

Date

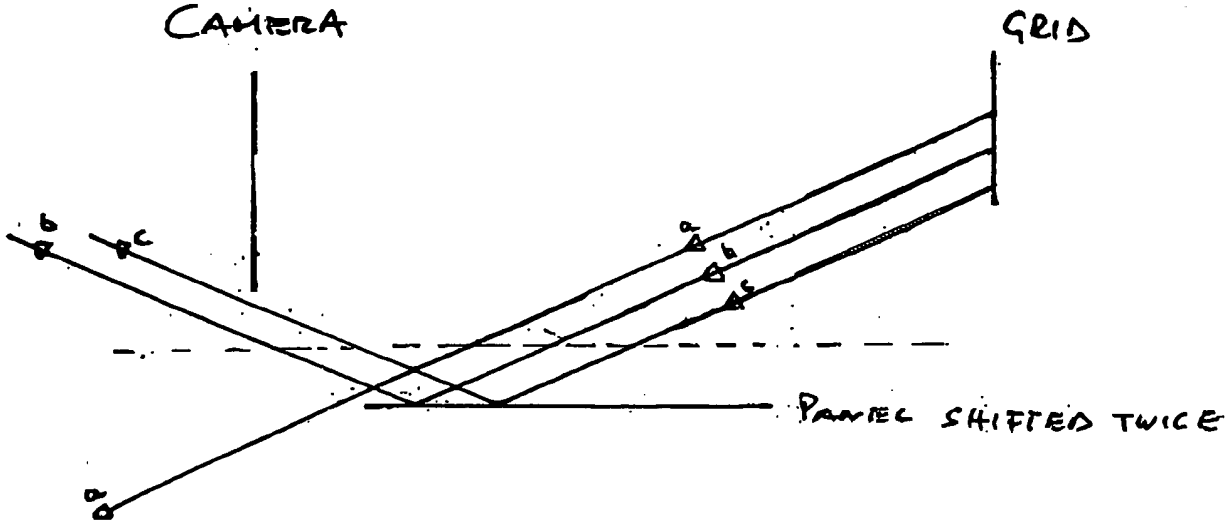
SCENARIO A



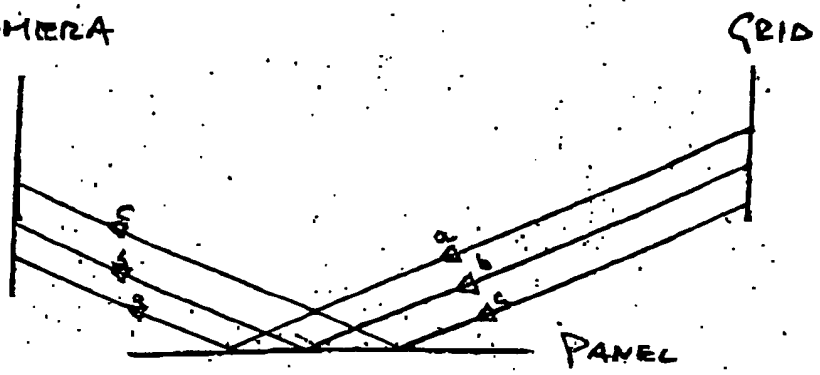
SCENARIO B



SCENARIO C



SZENARIO A1



SZENARIO B1